

TECHNICAL MANUAL

USE AND GRADES OF AIRCRAFT ENGINE LUBRICATING OILS

(ATOS)

F41608-87-D-A288

NOTE: The NATO/ASCC symbols for oils referenced herein are contained in T.O. 42B1-1-15, "NATO/ASCC Interchangeability of Aviation Fuels, Lubricants and Allied Products." The products listed in T.O. 42B1-1-15 as standardized are suitable for use in USAF equipment without additional technical guidance.

Prepared By: TRI-COR Industries, Inc.

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INTRODUCTION

1. PURPOSE.

The purpose of this technical order is to designate the grades of oil used in all reciprocating, turbine, turboprop, and turbofan USAF aircraft engines. Sampling procedures are also provided for when it becomes necessary to take samples from engines other than for the Joint Oil Analysis Program (JOAP). Consult T.O. 33-1-37-1, T.O. 33-1-37-2, T.O. 33-1-37-3, and T.O. 33-1-37-4 for information concerning the JOAP.

2. SCOPE.

In case of conflict between this technical manual and any aircraft or engine servicing manual, the aircraft/engine manual shall take precedence. If clarification of the instructions or data contained herein is required, contact DET 3, WR-ALC/AFTT, 2430 C Street, Bldg 70, Area B, Wright-Patterson AFB, OH 45433 (DSN: 785-8050).

CHAPTER 1

AIRCRAFT SERVICING

1.1 OIL SERVICING LEVELS.

CAUTION

Except during the initial servicing of an engine, do not check oil when engine is COLD. This can result in overservicing. Service engine oil tanks as soon as possible, but do not exceed 30 minutes after shutdown.

The oil tank filler opening on most aircraft is located so that with the filler cap removed, oil will overflow through the oil filler scupper drain when the tank is serviced to the normal full level. In other aircraft, when the oil filler overflow drain does not control the oil tank level, a dipstick is normally provided to determine the oil level. Oil tanks will be serviced to the normal full level, unless otherwise directed by applicable technical order. In no case will aircraft be serviced with oil without definitely determining the amount of oil in the tanks and servicing with oil, if necessary, to the levels indicated above.

1.1.1 Foam in Oil Tanks. Frequently, agitation of the oil by the engine under normal operating conditions may result in the formation of considerable foam in oil tanks. When the oil level is checked under such conditions, this foam may cause erroneous determination of the actual oil tank level. Oil tanks should always be serviced by filling

until the oil beneath the foam will overflow through the filler scupper drain or until the solid oil level reaches the full mark on the dipstick.

1.2 METHOD OF SERVICING.

Where equipment is available, engines will be serviced using an oil servicing unit. When hermetically sealed cans are used, they will be thoroughly wiped clean prior to each servicing to assure freedom from contamination. Reciprocating engine oil serviced from servicing units, or cans that are not hermetically sealed, will be filtered through a 60-mesh (or finer) screen. Turbine, turboprop, or turbofan engine oil serviced from cans which are not hermetically sealed will be filtered through a 100-mesh (or finer) screen.

1.3 PAINTING AND MARKING OF SERVICE EQUIPMENT.

Lubricating oil service equipment will be painted and marked in accordance with instructions outlined in T.O. 35-1-3.

1.4 SPECIFIC INSTRUCTIONS.

Specific servicing instructions for each type of aircraft/engine should be obtained from the applicable aircraft/engine technical order.

CHAPTER 2

RECIPROCATING ENGINE OIL

2.1 LUBRICATING OIL GRADES.

The grade of oil to be used in reciprocating aircraft engines is specified in the Pilot's Operating Instructions for the applicable aircraft. This is either Type II or Type III oil, Specification SAE J1899. See Table 2-1 for the applicable National Stock Numbers (NSNs).

2.2 SPECIAL CHARACTERISTICS OF SAE J1899 OIL.

Specification SAE J1899 oil is a mixture of petroleum base oil and additives to impart oxidation stability and dispersant properties. The ashless-dispersant additive prevents harmful deposits from building up on internal engine parts by keeping fuel combustion products in solution.

2.3 AIRCRAFT USE OF OIL, SPECIFICATION MIL-PRF-2104.

CAUTION

Specification MIL-PRF-2104 oil will never under any circumstances be mixed with any other engine oil.

NOTE

To flush the engine, drain old oil, service to minimums with replacement oil, run engine to normal operating temperatures, shut down and

drain oil, reservice, and perform leak check during rerun to normal operating temperatures. Check final service oil level within 30 minutes after shutdown.

Specification MIL-PRF-2104 oil can be used for certain utility aircraft only when specifically authorized. Emergency use of this oil should not exceed ten hours of operation. When using MIL-PRF-2104 oil, the engine will be drained and flushed prior to addition of this oil. Specification MIL-PRF-2104 oil will be drained and flushed and the engine refilled with the recommended oil.

2.4 EMERGENCY PROCUREMENT.

If it becomes necessary to make an emergency procurement of engine lubricating oil during cross-country flights, procurement will be made of the best available commercial oil conforming to the grade required. The latest DoD FLIGHT INFORMATION PUBLICATION (ENROUTE) – SUPPLEMENTS is published by Defense Mapping Agency. Aerospace Center (DMAAC) will show into-plane contract locations where Specification SAE J1899 is available.

2.5 BLOCK TESTING.

Aircraft engine oil, Specification SAE J1899, Type II, shall be used for block testing reciprocating engines, providing the following OIL IN temperature limits are maintained:

Minimum 71°C (160°F)

Maximum 90°C (195°F)

Table 2-1. Reciprocating Engine Oils

NSN	Container	Specification/Type	NATO Code
9150-00-168-6889	QT	SAE J1899, Type II	O-128
9150-00-065-0115	GL	SAE J1899, Type II	O-128
9150-00-753-5060	CN (5 gallons)	SAE J1899, Type II	O-128
9150-00-753-4937	DR	SAE J1899, Type II	O-128
9150-00-019-5701	QT	SAE J1899, Type III	O-123
9150-00-019-5705	GL	SAE J1899, Type III	O-123
9150-00-965-2303	CN (5 gallons)	SAE J1899, Type III	O-123
9150-00-965-2305	DR	SAE J1899, Type III	O-123

CHAPTER 3

TURBINE ENGINE OIL

3.1 TURBOJET, TURBOPROP, AND TURBOFAN ENGINE OILS.

WARNING

Some of the petroleum and synthetic type hydraulic oils/fluids often contain Tricresyl Phosphate (TCP) as additives, which is readily absorbed by the skin and is toxic. Any portion of the body that comes in contact with these oils/fluids should be cleaned as soon as possible. If skin or eye contact can be anticipated, appropriate protective equipment will be worn.

The applicable oils are used for lubrication of turbojet, turboprop, and turbofan engines (see Table 3-1).

3.2 SERVICING TURBINE ENGINE OIL.

CAUTION

Any oil remaining in opened containers after aircraft or equipment servicing will not be retained for future use but will be added to servicing equipment or disposed of as used oil. That is, partially filled containers will not be covered with a plastic cap, or similar device, for future use. This procedure is considered necessary to eliminate the possibility of contaminated oil.

Hermetically sealed quart or gallon cans are intended for flight line use. Container lids will not normally be cut off due to danger of metal particle contamination during such operation and increased probability of subsequent contamination by dust and moisture. Use a clean, sharp puncture type opener. Should it be necessary to examine the oil or can interior, cut the lid off in a sheltered area. Cans will be rendered unusable for any purpose after emptying and will be disposed of in accordance with existing regulations. Drums are intended for use at depot overhaul facilities or by field activities which have authorized servicing equipment.

3.3 OIL SERVICING EQUIPMENT.

Equipment currently authorized to service turbine engine oils are as follows.

3.3.1 Tank and Pump Unit, Type PMU-29/E. The PMU-29/E servicing units are equipped with a three-gallon reservoir tank and a smaller overflow tank. They also have quick-disconnect nozzles conforming to MIL-DTL-25677 and mate with adapters installed on fighter-type aircraft. For technical information on these units, see Technical Order (T.O.) Series 37A12-10 and 37A12-11. See following stock numbers available for PMU-29/E tanks:

- 4930-00-176-8574, 3 gal
- 4930-00-849-8933, 3 gal
- 4930-00-781-9591, 3 gal
- 4930-01-132-2444, 3 gal
- 4920-01-112-5013, 55 gal roll-around

3.3.2 Fluid Servicing Unit, Malabar Model 104. The Model 104 unit is used to service small amounts of oil into T-38, T-37, and A-10 aircraft. This small unit uses the one quart can as the reservoir and pumps oil through a three-micron absolute filter. The air vent on the unit has a 5 micron filter element. The servicing unit pumps at pressure ranging from zero to 300 psi at a rate of three fluid ounces per stroke. It may be locally procured from Malabar International, Simi Valley, CA 93062. See following part number available for unit:

- P/N WF1000-1Q-74

3.4 SPECIFIC ENGINE REQUIREMENTS.

Engines will be serviced with the applicable grades of lubricating oil (see Table 3-2).

3.5 COMPATIBILITY OF MIL-PRF-7808 SERIES OILS.

All oils, Specification MIL-PRF-7808, regardless of suffix designation (for example, MIL-PRF-7808G and MIL-PRF-7808H) are compatible and may be mixed in all proportions in any turbine, turboprop, or turbofan engine for which Specification MIL-PRF-7808 synthetic oils are specified. All oils, Specification MIL-PRF-7808, regardless of manufacturer, are compatible and may be mixed in all proportions. Each Specification MIL-PRF-7808 oil is checked for compatibility with all other Specification MIL-PRF-7808 oils prior to qualification of the oil to the specification.

Table 3-1. Turbine Engine Oil

Specification and Grade	NATO Code	Nomenclature	NSN and Container*
MIL-PRF-6081 1010	O-133	Lubricating Oil, Aircraft Turbine Engine	9150-00-273-2388 QT
MIL-PRF-6081 1005		Lubricating Oil, Aircraft Turbine Engine	No NSN Available
MIL-PRF-7808	O-148	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base	9150-00-782-2627 QT 9150-00-108-5359 CN 8 ounces
MIL-PRF-23699	O-156	Lubricating Oil, Aircraft Turbine Engine, Synthetic Base	9150-00-985-7099 QT 9150-00-180-6266 CN 8 ounces
*Refer to the Federal Supply Catalog for National Stock Numbers of other container sizes.			

3.6 COMPATIBILITY OF MIL-PRF-23699 SERIES OILS.

All oils, Specification MIL-PRF-23699, regardless of suffix designation (for example, MIL-PRF-23699A and MIL-PRF-23699B) are compatible and may be mixed in all proportions in any turbine, turboprop, or turbofan engine for which Specification MIL-PRF-23699 synthetic oils are specified. All oils, Specification MIL-PRF-23699, regardless of manufacturer, are compatible and may be mixed in all proportions. Each formulation of MIL-PRF-23699 oil is checked for compatibility with all other formulations of MIL-PRF-23699 oils prior to qualification of the oil to the specification.

3.7 EMERGENCY SERVICING.

In case of emergency, engine lubricating oils NATO Codes O-148 (MIL-PRF-7808), O-149, O-150 and O-156

(MIL-PRF-23699), may be mixed. The amount of emergency oil added should not exceed one-half of the oil tank capacity. At the first opportunity thereafter, the oil shall be drained and the engine serviced with the proper lubricating oil as specified in Table 3-2 of this document and the applicable engine technical orders.

3.8 CONDEMNED TURBINE ENGINE OIL.

Refer to T.O. 42B-1-1 for retest information and condemned lots of MIL-PRF-7808 and MIL-PRF-23699 turbine engine oils.

3.9 BLOCK TESTING.

Turbine, turboprop, and turbofan engines shall be block-tested on oil as specified in Chapter 4.

Table 3-2. Jet Engine Lubricating Oil Chart

Engine	Lubricating Oil	Aircraft
CF6-50E	MIL-PRF-7808	E-4
J33	MIL-PRF-6081, Grade 1010	T-33A
J47	MIL-PRF-6081, Grade 1010	KC-97L
J57	MIL-PRF-23699 (primary) MIL-PRF-7808**** (alternate)	B-52B, C, D, E, F, G, C/KC-135 Series F-100C, D, F, F-101A, B, C F102 Series
J60	MIL-PRF-7808* or MIL-PRF-23699	C/VC-140A, B T-39A, B WB-57F
J65	MIL-PRF-7808	B-57B RF/F-84F
J69	MIL-PRF-23699 or MIL-PRF-7808*****	T-37A, B
J71	MIL-PRF-7808	B/RB/WB-66B, C, D
J75	MIL-PRF-23699* or MIL-PRF-7808	F/JF-105B, D, F
J75	MIL-PRF-7808* or MIL-PRF-23699	QF/YQF/F-106A, B
J79	MIL-PRF-7808	F-4 Series
J85	MIL-PRF-7808	Y/AT-37D T-38A F-5
JT3D-3B	9150-00-913-9717	C-137B/C
JT8D-9	9150-00-913-9717	C-9A T-43A
JT8-D-17	MIL-PRF-7808	C-15
TF30	MIL-PRF-7808H*** or later revision	F/FB/EF-111 Series
YTF/TF33	MIL-PRF-23699 (primary) MIL-PRF-7808***** (alternate)	B-52H WB-57F E/EC/KC/RC-135 Series C-18A E3A
TF33	MIL-PRF-23699	C-141A/B
TF34-100	MIL-PRF-7808***** (primary) MIL-PRF-23699 (alternate)	A-10
XTF/YTF/TF39	MIL-PRF-7808	C-5A
TF41	MIL-PRF-7808** or MIL-PRF-23699	A-7D/K
F100-PW-100	MIL-PRF-7808J***** or later revision, or MIL-PRF-23699C or later revision	TF/F-15A/B/C/D
F100-PW-200	MIL-PRF-7808J***** or later revision, or MIL-PRF-23699C or later revision	YF/F-16A/B/C/D
F100-PW-220	MIL-PRF-7808J***** or later revision, or MIL-PRF-23699C or later revision	F-15A/B/C/D/E F-16A/B/C/D
F100-PW-229	MIL-PRF-7808J***** or later revision, or MIL-PRF-23699C or later revision	F15E, F16C/D
F110-100/-129	MIL-PRF-7808 or MIL-PRF-23699	F-16C/D

Table 3-2. Jet Engine Lubricating Oil Chart - Continued

Engine	Lubricating Oil	Aircraft
F110-400	MIL-PRF-23699 or MIL-PRF-7808	F-14A/D
F101	MIL-PRF-7808	B-1
F108-CF-100	MIL-PRF-7808 or MIL-PRF-23699	KC-135R
F404-GE-F1D2	MIL-PRF-7808 or MIL-PRF-23699	F-117A
T53	MIL-PRF-7808* or MIL-PRF-23699	HH-43B, F HH-1H UH-1B, D
PT6A-20	MIL-PRF-23699	VC-6A
PT6A-27	MIL-PRF-23699	UV-18
PT6A-38	MIL-PRF-23699	C-12A
YT54	MIL-PRF-7808	XF-86H1
T/YT55	MIL-PRF-7808	CH-47A YAT-28A
T/YT56	MIL-PRF-7808* or MIL-PRF-23699	C-130 All Series YC-131C
T58	MIL-PRF-7808	CH-3B,C UH-1F CH/HH-3E
T64	MIL-PRF-7808	HH-53B, C CH-53A (Marines)
T76	MIL-PRF-7808* or MIL-PRF-23699	OV-10
T400-CP-400	MIL-PRF-7808* or MIL-PRF-23699	UH-1N
<p>*When starting temperatures are below -25°F (-32°C), use MIL-PRF-7808.</p> <p>**When starting temperatures are below -40°F (-40°C), use MIL-PRF-7808. The TF-41 Engine may be operated in an emergency situation with a mixture of MIL-PRF-7808 and MIL-PRF-23699. But the oil mixture must be changed at the earliest opportunity to one type oil. Oils must not be mixed in the Constant Speed Drive (CSD).</p> <p>***Oils procured under old MIL-L-7808 revisions are not to be used. Only oils conforming to MIL-PRF-7808 should be used.</p> <p>****When starting temperatures are below -40°F (-40°C), use MIL-PRF-7808.</p> <p>*****For F-100 series engines, oils meeting MIL-PRF-7808 and MIL-PRF-23699 specifications are compatible and may be mixed in all proportions. When starting temperatures are below -40°F (-40°C), use MIL-PRF-7808.</p>		

CHAPTER 4

SAMPLING LUBRICATING OIL FROM AIRCRAFT (OTHER THAN JOINT OIL ANALYSIS PROGRAM)

4.1 PROCEDURE.

When it is necessary to test lubricating oil for contamination and/or conformance to specification requirements, a representative sample will be taken from the oil system as follows:

- a. Prior to sampling, motor or run-up the engine for a few minutes to uniformly distribute any foreign material in the oil.
- b. The sample shall be taken from the filler neck by means of an oil gun, thief, or drained from the tank. A thief is a device such as a clean plastic or metal tube (glass will never be used). It is inserted through the filler neck, approximately 3 inches from the tank bottom. The tube is closed while in the oil to retain the sample, and then withdrawn. It is a slow procedure unless tube diameter is relatively large. It shall not be used unless the filler neck opening can be protected from the rain and dust.
- c. When a representative sample is taken from the tank drain, the drain line and tank bottom will be cleared of residual material by draining and discarding at least one-half pint of the oil or until drain tubes are cleared.

4.2 SAMPLE SOURCE.

The source of samples will vary with the relationship of the oil to the suspected problem. For example, water in the oil may be suspected as the cause of an engine problem. It is important then to sample the oil from a point which will provide a true indication of water content. This is the lowest point in the system. At the same time, a sample shall be taken from the engine oil tank to serve as a basis for comparison. Samples may be taken from tank drains, tank inlet, accessory housings, or other points depending upon any given engine oil system configuration. To establish the quality of the new oil as a basis of comparison, a sample of four unopened 1-quart cans or one 1-gallon can representing flight line stocks will be forwarded with the used oil samples. A 1-gallon sample will be forwarded from storage or servicing containers which contain 5 gallons or more.

4.3 SPECIAL SAMPLE.

When a special sample is needed, the choice of a sampling point is important, as stated before; however, it may not be possible to obtain drain or THIEF samples in some cases (for example, after an accident). Then, samples will be taken by any means necessary to obtain clean, representative samples.

4.4 SAMPLE CONTAINERS.

Samples will be taken in 1-quart sample bottles or 1-gallon cans. Funnels will be necessary to fill the sample container. Applicable National Stock Numbers (NSNs) for sample containers are:

- Sampling Kit (4 quart bottles)/NSN 8115-00-719-4111
- One gallon epoxy-lined can/NSN 8110-00-128-6819

Funnels and all sample cans/bottles shall be cleaned prior to use. Wash cans/bottles in a hot soap and water solution, rinse with tap water, and then with distilled water. Dry in an oven (212°F). Assistance may be obtained from local Base Fuels Office.

4.5 SAMPLE IDENTIFICATION.

Each sample shall be properly identified as to its source. Sample tags, AFTO Form 475, will be used for this purpose. The tags shall be securely fastened to the sample container. Identify the engine from which the sample was taken by Serial No., or aircraft tail number and engine position (No. 1, 2, etc.). Indicate source of the oil sample: tank, tank drain, etc. The number of hours since the last oil change is helpful. A letter to the laboratory explaining why the samples were taken shall accompany or precede the sample.

4.6 SAMPLE SUBMISSION.

Air Force activities will submit samples for analysis/testing to the appropriate Aerospace Fuels Laboratory in accordance with T.O. 42B-1-1. The completed AFTO Form 475 shall accompany each sample.

CHAPTER 5

VOLUME CORRECTION

5.1 PROCEDURE FOR BULK OIL SHIPMENT OR RECEIPT.

Aircraft engine oil received in bulk shipments in measured or gaged volume may be corrected to volume at 60°F by use of the American Petroleum Institute:

- Manual of Petroleum Measurement Standards
- Chapter 11.1 – Volume Correction Factors
- Volume II, Table 6B

